REMARKS

Reconsideration and allowance of the above application as amended are respectfully requested.

Claims 1-14, 32-33 are pending, with Claims 1, 9, 13, and 32 being independent.

Claims 1-3 and 8 stand rejected under 35 U.S.C. 102(e) as allegedly being anticipated by Tong et al. (US Patent 6,827,252). This contention is respectfully traversed.

Claims 4-5 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Tong in view of Mikagi et al (US Pat. Pub. 2003/0025202). This contention is respectfully traversed.

Claim 6 stands rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Tong as applied to claim 1 above, and in further view of Lopatin et al (US Patent 6,528,409). This contention is respectfully traversed.

Claim 7 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Tong in view of Tatoh (US Patent 6,614,590). This contention is respectfully traversed.

Claims 9-10 and 13 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Tong in view of Jin et al (US Patent 6,740,577). This contention is respectfully traversed.

Claims 11-12 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Tong in view of Jin as applied to claim 10 above, and further in view of Mikagi. This contention is respectfully traversed.

Claim 14 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Tong and Jin as applied to claim 9 above, and further in view of Lopatin and Tatoh. This contention is respectfully traversed.

Claims 32 and 33 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Tong in view of Kazama et al (US Patent 6,639,315). This contention is respectfully traversed.

35 U.S.C. 112 Rejections - Claims 2, 8, 10, 13

Claims 2 and 10 are definite for particularly pointing out and distinctly claiming patentable subject matter. For example, Claims 2 and 10 recite that the "diffusion barrier is an electroless diffusion barrier configured to suppress whisker-type formation in the bump". No new matter has been added. As pointed out in the Applicants' response to the Office Action mailed Aug. 24, 2004, the disclosure clearly describes and points out electroless diffusion barriers and deposits on page 5, lines 26-31 and page 6, lines 1-13. (Also see, for example, page 7, lines 13-14; 24-25; page 8, lines 10-11, 25-26, 29-30;

page 9, lines 1-4). Furthermore, the amendments to Claims 2 and 10 recite patentable subject matter from Claim 12 describing the diffusion barrier. For at least these reasons, the Applicants' respectfully submit that the 35 U.S.C. 112, second paragraph, rejection to Claims 2 and 10 is improper and should be withdrawn.

The amended Claim 8 is definite. The Applicants submit that the amended Claim 8 particularly points out and distinctly claims patentable subject matter, and the amendments obviates the rejection. Therefore, the 35 U.S.C. 112, second paragraph, rejections should be respectfully withdrawn.

Claim 13 is definite because the feature of "the base layer metal further contacts the diffusion barrier to physically isolate the bump from the solder layer" is clearly shown in Fig. 6 and described in the disclosure on page 8, lines 23-31 and page 9, lines 1-7. For example, "the bump layer 615 may be physically isolated from direct physical contact with a layer that may include Sn" (see page 8, lines 30-31 in the disclosure). The Applicants submit that the Claim 13 particularly points out and distinctly claims patentable subject matter. Therefore, the 35 U.S.C. 112, second paragraph, rejection should be respectfully withdrawn.

35 U.S.C. 102 - Claims 1-3 and 8

Claim 1 is patentable over Tong because Tong fails to anticipate each and every feature of the claim as arranged in the claim. For a claim to be anticipated by the prior art, it is necessary that a single prior art reference disclose each element of the claim under consideration. *Minnesota Mining and Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 1565 (Fed. Cir. 1992).

Tong fails to disclose the features of "the diffusion barrier is configured to prevent Cu and Sn from diffusing through the diffusion barrier". For example, Tong teaches a method of forming bumps on the active surface of a silicon wafer, in which a under-ball metallic layer serves as a barrier blocking diffusion of metallic particles into the insulation layer inside the wafer (Tong: Abstract; Col. 6, lines 43-46). However, Tong fails to disclose that the diffusion barrier layer is configured to prevent Cu and Sn from diffusing through the diffusion barrier. In contrast, Tong discloses that the diffusion barrier layer itself can include Cu. However, Claim 1 recites that the base layer metal includes Cu. The base layer metal in Claim 1 is the layer underneath the diffusion barrier layer, and not the diffusion barrier itself. For at least this reason, Tong fails to anticipate Claim 1.

Furthermore, Tong fails to disclose the feature of preventing "CuSn intermetallic formation ... in the apparatus". Tong discloses that the solder bump layer above the barrier layer can include both Cu and Sn (Col. 2, lines 60-65). In Tong, the Sn from the solder bump layer and the Cu from the barrier layer can form the undesirable CuSn intermetallics shown in the defective bump diagrams of FIGS. 1A-1D in the instant disclosure. Hence, the rejection under 35 U.S.C. 102 is improper.

Therefore, Tong fails to anticipate Claim 1 at least because Tong discloses that the diffusion barrier layer itself can include Cu, while Claim 1 recites that the base layer metal includes Cu. Moreover, Tong fails to anticipate Claim 1 at least because the diffusion barrier layer as disclosed in Tong does not prevent CuSn intermetallic formation in the apparatus as recited in Claim 1.

In regards to a process designation for a feature of the claim, Claim 1 has been amended to obviate this aspect of the rejection. For example, the bump layer is an electroplated bump layer. Claim 1 does not recite a step for a process for forming the electroplated bump layer. Therefore, Claim 1 recites patentable subject matter.

At least because Tong fails to anticipate each and every feature of the claim, the Applicants submit that Claim 1 is

patentable over Tong, and the rejection under 35 U.S.C. 102 should be respectfully withdrawn.

Claims 2 and 8

Claims 2 and 8 are patentable at least for depending on an allowable base claim, Claim 1. Therefore, Claims 2 and 8 are also patentable for reciting allowable subject matter in their own right.

35 U.S.C. 103 Rejections - Claims 4-7, 9-10, 13-14, 32-33

Claims 4-5

Claims 4-5 are patentable over Tong and Mikagi because neither reference, alone or in combination, teaches or suggests all of the features as arranged in the claims. To have a valid 35 U.S.C. 103 rejection, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. MPEP 2142, 2143. The prior art reference (or references when combined) must teach or suggest all the claim limitations. Moreover, hindsight is not allowed in making a 35 U.S.C. 103 rejection. The teaching or suggestion to make the claimed combination and a reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Mikagi fails to remedy the deficiencies of Tong as described above with repect to the 35 U.S.C. 102 rejection to Claim 1. Mikagi teaches a semiconductor device having an external electrode (Mikagi: Abstract). However, Mikagi fails "to prevent Cu and Sn from diffusing through the diffusion barrier and to prevent CuSn intermetallic formation" as recited in Claim 1. Instead, the suggested structure shown in Mikagi does not prevent CuSn intermetallic formation because the "Sn

component in the solder ball 20" can form CuSn intermetallics with multiple Cu layers, including the "solder-wetting Cu film 35" and the "see Cu film 33" (See Mikagi: Col. 7, paragraphs 86-88; Figs. 17-18). Therefore, whether the references are used individually or in combination, the Sn from the solder bump layer and the Cu from the barrier layer can form the undesirable CuSn intermetallics as shown in the defective bump diagrams of FIGS. 1A-1D in the instant disclosure. For at least this reason, dependent Claims 4-5 are patentably distinguishable over the cited references.

Claim 6

The amended Claim 6 is patentable over Tong and Lopatin because neither reference, alone or in combination, teaches or suggests all of the features as arranged in the claim. Lopatin teaches an method for fabricating an interconnect structure within and interconnect opening formed within a porous dielectric material (Lopatin: Abstract). However, Lopatin fails to remedy the deficiencies of Tong as recited above with respect to the base claim, Claim 1. For at least this reason, the amended Claim 6 is distinctly patentable over the cited references.

Claim 6 is also patentable over the cited references at least because the cited references fail to teach or suggest a

diffusion barrier comprising one of NiBP, NiWP, NiWB, and NiWBP as recited in Claim 6. Therefore, the rejection under 35 U.S.C. 103 is improper and Claim 6 should be respectfully allowed.

In regards to a process designation for a feature of the claim, Claim 6 has been amended to obviate this aspect of the rejection. For example, the bump layer is an electroplated bump layer (see base Claim 1). Claim 6 does not recite a step for a process for the electroplated bump layer. Therefore, Claim 6 recites patentable subject matter.

Claim 7

The amended Claim 7 is patentable over Tong and Tatoh at least because these references fail to teach each and every feature of the claim as recited in the claim and the base claim, Claim 1. Tatoh discloses an optical semiconductor hermetic sealing package for accommodating an optical semiconductor element (Tatoh: Abstract). However, Tatoh fails to remedy the deficiencies of Tong as described above with respect to the base claim, Claim 1. For at least this reason, Claim 7 the rejection under 35 U.S.C. 103 is improper and should be respectfully withdrawn.

Claim 7 is also patentable for reciting patentable subject matter in its own right. For example, the cited references fail to teach or suggest a "wetting layer comprising one of CoB and

NiP" as recited in the amended Claim 7. Therefore, Claim 7 is patentably distinguishable over the cited references.

Claims 9-10, 13

The amended Claims 9-10, 13 are patentable over Tong and Jin at least because these references fail to teach each and every feature as recited in the claims.

Claim 9 is patentable for at least the same reasons as Claim 1. Jin fails to remedy the deficiencies of Claim 9. Jin teaches a method of forming a small pitch torch bump for mounting high-performance flip-flop devices (Jin: Abstract). However, Jin fails "to prevent Cu and Sn from diffusing through the diffusion barrier and to prevent CuSn intermetallic formation" as recited in Claim 9. Instead, the suggested structure shown in Jin does not prevent CuSn intermetallic formation because the layers of metal as the base of the solder ball can form CuSn intermetallics because they can include Cu (See Jin: Col. 6, lines 4-9; Col. 5, line 19; Col. 3, line 51). For at least this reason, Claim 9 is distinctly patentable over the cited references.

Furthermore, even if the references could be combined or modified, that does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed.

Cir. 1990). At least because hindsight is impermissible for obviousness-type rejections, Claim 9 is patentable over the cited references.

Claim 10 is patentable over the teachings of the cited references because the Jin and Tong, alone or in combination, fail to teach each and every feature of the base claim, Claim 9. Allowance of Claim 10 is respectfully requested.

Claims 13 includes features that are similar to Claims 1 and 9 and is patentable for at least the same reasons as those independent claims.

Claims 11-12

Claims 11-12 are patentable over Tong, Jin, and Mikagi at least for depending upon an allowable base claim, Claim 9. Allowance of Claims 11-12 is respectfully requested.

Claim 14

Claim 14 is patentable over Tong, Jin, Tatoh, and Jopatin, for at least depending on an allowable base claim, Claim 13. Allowance of Claim 14 is respectfully requested.

Claims 32-33

Claim 32 includes some features that are similar to Claim 1, and Claim 32 is patentable over Tong and Kazama for the same

reasons as described above with respect to Claim 1. Kazama, in showing a circuit board (10) with a circuit for routing a signal, fails to remedy the deficiencies of Tong (Kazama: Abstract; Fig. 5). The Applicants' respectfully request that the rejection under 35 U.S.C. 103 rejection to Claim 32 be withdrawn and Claim 32 be placed in condition for allowance.

Claim 33 is patentable for depending on an allowable base claim, Claim 32. Allowance of Claim 33 is respectfully requested.

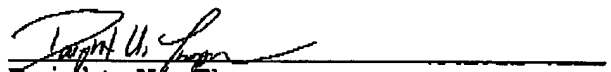
Conclusion

In view of the amendments and remarks herein, the Applicants believe that Claims 1-14, 32-33 are in condition for allowance and ask that these pending claims be allowed. The foregoing comments made with respect to the positions taken by the Examiner are not to be construed as acquiescence with other positions of the Examiner that have not been explicitly contested. Accordingly, Applicants' arguments for patentability of a claim should not be construed as implying that there are not other valid reasons for patentability of that claim or other claims.

No fee is believed to be due at this time. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: May 24, 2005



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